TILE COUNCIL OF NORTH AMERICA, INC.

PRODUCT TESTING SERVICE

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TEST REQUESTED BY: **Regan Scientific Instruments**

INTRODUCTION:

The client requested that testing be performed to determine the dynamic coefficient of friction (DCOF) of polished concrete reference surfaces using the test method in ANSI A137.1 section 9.6.

A concrete pad was poured and allowed to cure before being ground and polished by representatives from the Concrete Polishing Association of America (CPAA). The pad was ground to varying levels of aggregate exposure, classified by the client as large aggregate, medium aggregate, sand salt & pepper, and cream. The pad was also polished to varying levels of gloss, determined by the client to be low gloss, medium gloss, high gloss, and very high gloss. The finished concrete was tested in accordance with ANSI A137.1 section 9.6, modified as necessary substituting "polished concrete samples" where tiles are referenced. Additional details about the concrete pour, polishing, and testing are below.

TEST SUBJECT MATERIAL:

The client commissioned American Concrete and Construction of Anderson, SC (hereinafter "American Concrete") to pour a 20' x 45' concrete pad in TCNA's "high bay" facilities. The mix design was as agreed upon between American Concrete and a CPAA representative, Ms. Jennifer Faller. On the date of the concrete pour the high bay facility ranged from 58°F to 65°F and from 56% to 67% relative humidity. Photos of the pour can be found in Appendix B.

Per CPAA instruction, the concrete pad was allowed to cure for 33 days before grinding and polishing was performed. Grinding and polishing was done under the direct supervision of Ms. Jennifer Faller, representing CPAA. A concrete polishing machine[1] was used to grind and polish the various test sections. The concrete slab was sectioned off into three (3) pads, each with twenty (20) - 3' x 4' test sections. Per pad, a test section was made for each of the following aggregate exposure levels and gloss levels, a total of 16 sections. The four remaining sections were left unfinished for potential future testing:

Aggregate Exposure
Class A: Cream
Class B: Sand Salt & Pepper
Class C: Medium Aggregate
Class D: Large Aggregate

Gloss Level[2]
Level 1: Low Gloss
Level 2: Medium Gloss
Level 3: High Gloss
Level 4: Very High Gloss

See Appendix A for the diagram showing the layout of test sections and Appendix B for photos of the pour and polishing process.

[1] Information about the model of concrete polishing machine that was used is available from TCNA.
[2] Gloss level stated by CPAA and self-evident but not independently quantified by TCNA.

Katelyn Simpson
Laboratory Manager

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TEST DATE: 12/23/14-1/7/15

TEST METHOD: **ANSI A137.1-2012 Section 9.6: "Wet Dynamic Coefficient of Friction (DCOF)"**

Informal Test Method Description: This test method covers the measurement of dynamic coefficient of friction of ceramic tile or other hard surfaces under the wet condition using the BOT 3000 device.

This summary is provided for the reader's convenience and is not a complete description of the method. See ANSI A137.1 Section 9.6 for all method details and information.

TEST PROCEDURE:
Three randomly selected 12"x12" sample areas on each 3'x4' test section were tested (see Appendix A for selected areas). The randomly selected areas will be called "samples" for ease of reporting.

The samples were cleaned with Renovator #120 per the method then allowed to dry prior to testing. The SBR test sensor was prepared using the sanding device specified in the method, then verified using the standard tile. The sensor was resurfaced after testing the standard tile and after every four measurements.

Each sample was tested in all four directions using a calibrated BOT 3000E machine, serial #0134 (next calibration due 08/2015) with the travel distance set to 10″. All testing was performed under wet conditions using 0.05% SLS water specified by the method. Special care was taken to perform the test immediately after spreading the SLS water over the sample simulating a fresh spill condition. Testing was conducted while water was present on the surface and before it noticeably absorbed into the sample or evaporated. Four measurements were made on each sample for a total of 12 measurements on the 3'x4' test section. The test procedure above was repeated on all 48 - 3'x4' test sections.

All testing was performed in the TCNA "high bay" facility where the temperature ranged from 60°F to 66°F and relative humidity ranged from 25% to 67%. Temperature and humidity information for each day of testing was recorded.

TEST RESULTS:
Individual data points for each "sample" tested can be found in Appendix A. The average of four measurements for each "sample" is reported below.

The average dynamic coefficient of friction (DCOF) for each "sample" on all 48 - 3'x4' test sections exceeded 0.42. Additionally, there was a larger difference in DCOF observed with the change in gloss level than was observed with the change in aggregate exposure (see charts 1, 2, and 3 below).

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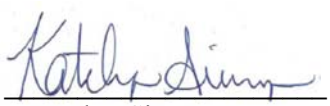
TEST RESULTS CONTINUED:

Low Gloss								
	Large Aggregate		Medium Aggregate		Sand Salt & Pepper		Cream	
	Sample	DCOF	Sample	DCOF	Sample	DCOF	Sample	DCOF
Pad 1	1	0.57	1	0.59	1	0.57	1	0.56
	2	0.58	2	0.57	2	0.57	2	0.56
	3	0.59	3	0.61	3	0.57	3	0.57
Pad 2	1	0.56	1	0.6	1	0.61	1	0.58
	2	0.56	2	0.61	2	0.57	2	0.58
	3	0.56	3	0.59	3	0.6	3	0.58
Pad 3	1	0.54	1	0.56	1	0.58	1	0.59
	2	0.55	2	0.56	2	0.57	2	0.59
	3	0.54	3	0.56	3	0.57	3	0.57
	Average	0.56	Average	0.58	Average	0.58	Average	0.58

Medium Gloss								
	Large Aggregate		Medium Aggregate		Sand Salt & Pepper		Cream	
	Sample	DCOF	Sample	DCOF	Sample	DCOF	Sample	DCOF
Pad 1	1	0.53	1	0.54	1	0.55	1	0.56
	2	0.52	2	0.52	2	0.55	2	0.57
	3	0.53	3	0.53	3	0.56	3	0.54
Pad 2	1	0.53	1	0.49	1	0.57	1	0.56
	2	0.54	2	0.5	2	0.57	2	0.55
	3	0.54	3	0.54	3	0.57	3	0.55
Pad 3	1	0.53	1	0.53	1	0.54	1	0.55
	2	0.53	2	0.49	2	0.55	2	0.53
	3	0.54	3	0.52	3	0.54	3	0.55
	Average	0.53	Average	0.50	Average	0.56	Average	0.55



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TEST RESULTS CONTINUED:

High Gloss								
	Large Aggregate		Medium Aggregate		Sand Salt & Pepper		Cream	
	Sample	DCOF	Sample	DCOF	Sample	DCOF	Sample	DCOF
Pad 1	1	0.52	1	0.52	1	0.51	1	0.51
	2	0.52	2	0.52	2	0.51	2	0.53
	3	0.49	3	0.52	3	0.51	3	0.52
Pad 2	1	0.52	1	0.49	1	0.54	1	0.51
	2	0.5	2	0.49	2	0.53	2	0.48
	3	0.49	3	0.5	3	0.54	3	0.51
Pad 3	1	0.51	1	0.52	1	0.54	1	0.56
	2	0.51	2	0.51	2	0.53	2	0.54
	3	0.53	3	0.51	3	0.52	3	0.54
	Average	0.51	Average	0.51	Average	0.53	Average	0.52

Very High Gloss								
	Large Aggregate		Medium Aggregate		Sand Salt & Pepper		Cream	
	Sample	DCOF	Sample	DCOF	Sample	DCOF	Sample	DCOF
Pad 1	1	0.46	1	0.51	1	0.47	1	0.47
	2	0.48	2	0.46	2	0.49	2	0.52
	3	0.47	3	0.49	3	0.49	3	0.5
Pad 2	1	0.49	1	0.49	1	0.53	1	0.51
	2	0.48	2	0.47	2	0.52	2	0.51
	3	0.5	3	0.51	3	0.53	3	0.49
Pad 3	1	0.53	1	0.53	1	0.44	1	0.54
	2	0.52	2	0.53	2	0.47	2	0.5
	3	0.52	3	0.5	3	0.48	3	0.54
	Average	0.49	Average	0.50	Average	0.49	Average	0.51

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TEST RESULTS CONTINUED:

The table below shows the two tail P-Values for various comparisons of results. For the probability of a statistically significant difference between sets of data, with 95% confidence, the p-value must be below 0.05. The lower the p-value, the more significantly different the data sets are.

In only three cases (marked below with an asterisk) the difference in polish did not show a statistically significant difference in DCOF between one level of polish and the next. In all other cases, a different level of polish resulted in statistically significant differences in DCOF. In the three cases where there was not a statistically significant difference, additional analysis was done (included below) to show that the next step in gloss did show a significant difference. For example, for the medium aggregate data, the very high and high gloss level were not significantly different in measured DCOF, but the very high to medium gloss DCOF values were significantly different. When averaging DCOF values across all aggregates, each level of polish was statistically differentiated from the other levels of polish.

While the difference in results between very high to high gloss test sections was less statistically differentiated than the results from high to medium and medium to low gloss, all combined aggregate values have a confidence level well in excess of 99.99% confidence.

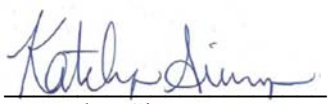
Large Aggregate	
Comparison	P-Value (two-tail)
Very High to High Gloss	0.00515
High to Medium Gloss	7.34E-08
Medium to Low Gloss	1.09E-11

Medium Aggregate	
Comparison	P-Value (two-tail)
Very High to High Gloss	0.054446*
High to Medium Gloss	0.051239*
Medium to Low Gloss	9.82E-20
Very High to Medium	0.000919

Sand Salt & Pepper	
Comparison	P-Value (two-tail)
Very High to High Gloss	4.83E-06
High to Medium Gloss	1.37E-11
Medium to Low Gloss	3.98E-08

Cream	
Comparison	P-Value (two-tail)
Very High to High Gloss	0.071739*
High to Medium Gloss	1.22E-08
Medium to Low Gloss	5.17E-11
Very High to Medium	6.06E-11

All Aggregate Data Combined	
Comparison	P-Value (two-tail)
Very High to High Gloss	2.41E-07
High to Medium Gloss	2.77E-18
Medium to Low Gloss	4.65E-36



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TEST RESULTS CONTINUED:

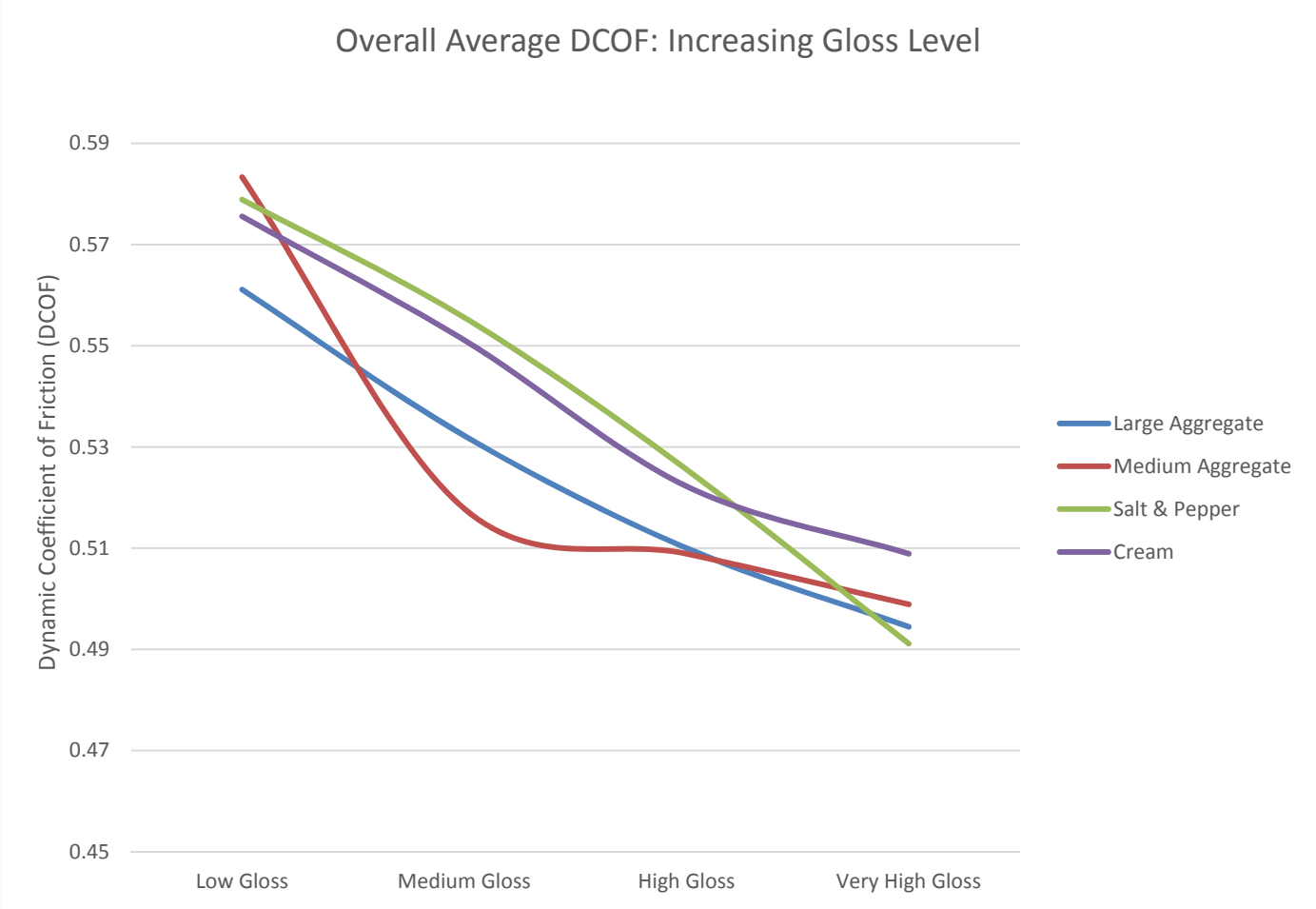

Chart 1: The chart above shows the overall average of all measurements for each aggregate exposure in order of increasing gloss.

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TEST RESULTS CONTINUED:

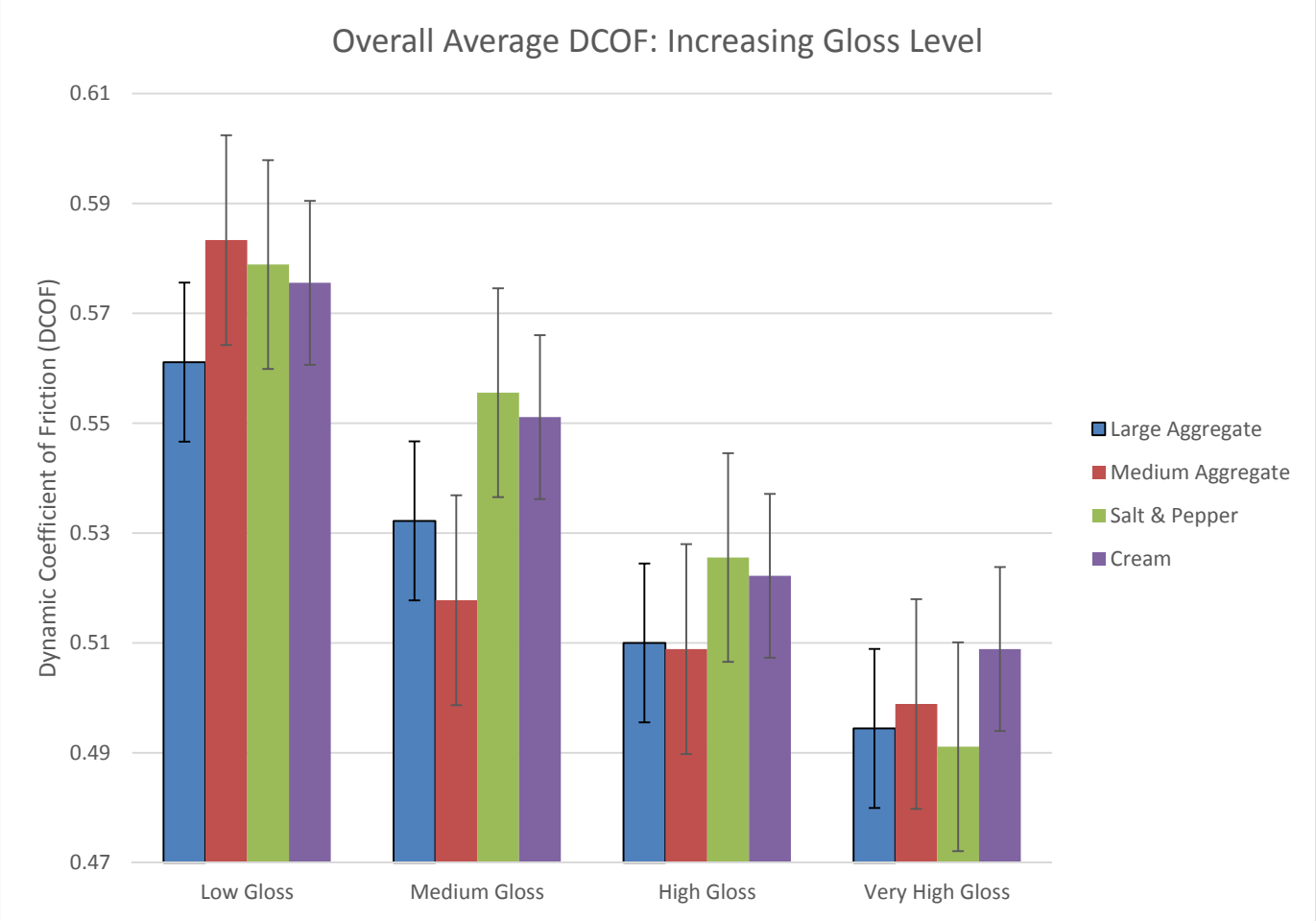

Chart 2: The chart above shows the overall average of all measurements for each aggregate exposure in order of increasing gloss with standard error bars included. The top of the colored bar is the average for each data set.

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TEST RESULTS CONTINUED:

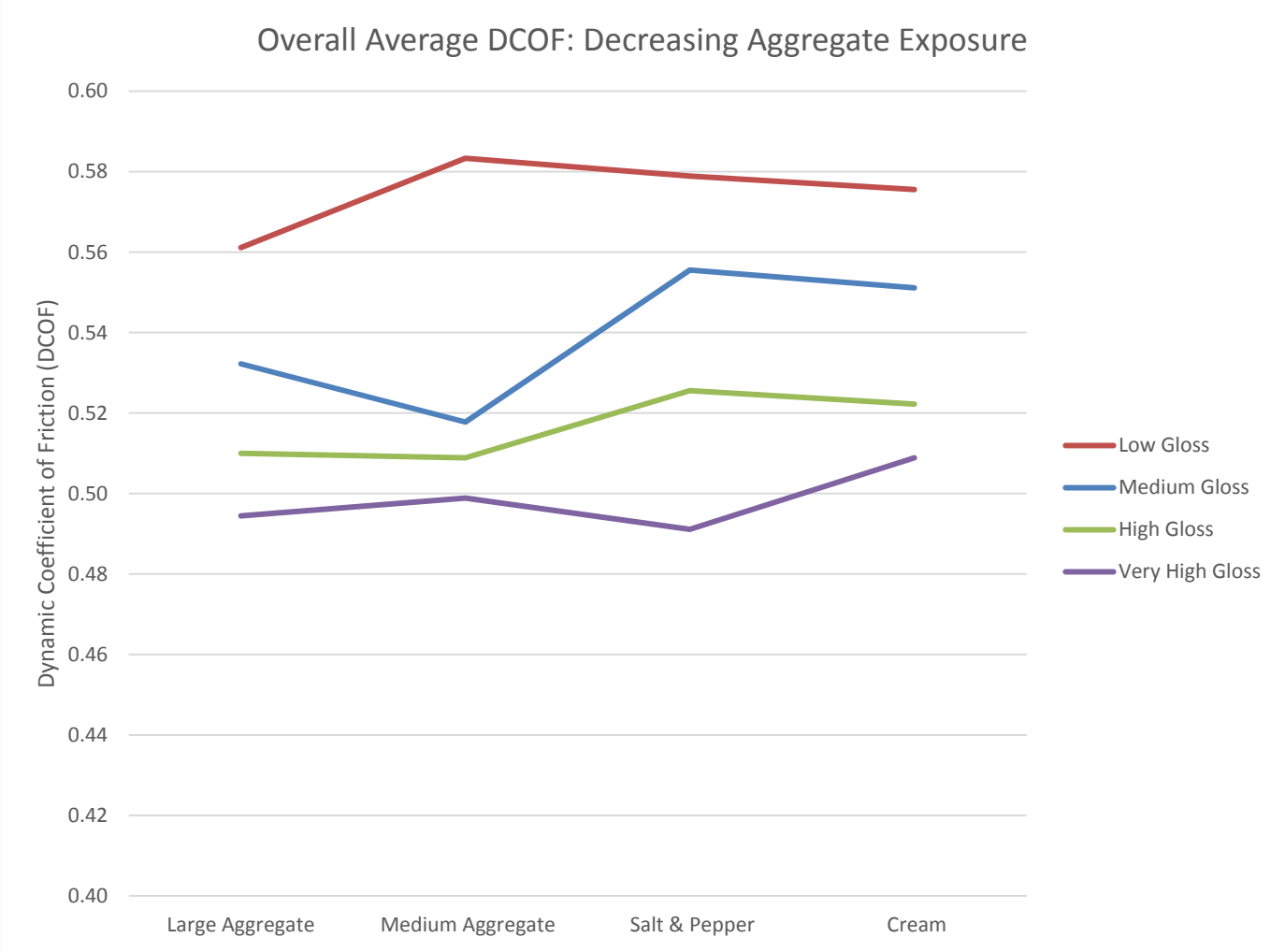

Chart 3: The chart above shows the overall average of all measurements for each gloss level in order of decreasing aggregate exposure level. This chart shows another view of the significant difference in data based on gloss level. We did not observe a meaningful change in DCOF related to size of aggregate.

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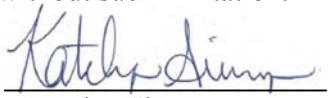
ADDITIONAL OBSERVATIONS:

In the performance of this testing, we observed a difference in the DCOF of polished surfaces that were pre-saturated with water and those that were dry before testing. As per the test method described in this report and further described in Section 9.6 of the ANSI A137.1 standard, the surface being tested was clean and dry before testing. As such, the test procedure used simulated a spill on a dry surface. We did not endeavor to quantify the change in DCOF when the polished surface being tested was pre-saturated with water, as that work was outside the scope of this research and engagement. From the limited measurements we made, however, we believe the difference is meaningful and significant.

One of the properties of polished concrete surfaces is that they can absorb spills, going from a wet with standing water condition to nearly dry condition as the spill is absorbed. The rate of absorption likely is dependent on several factors including, but not in limitation, the sand/cement ratio, free moisture content, level of compaction, type and size of aggregate, degree of polish, and available potential for evaporation. As such, the DCOF of a polished concrete surface has a time-dependent component, with DCOF expected to improve as the surface dries. Testing per the procedure in Section 9.6 is understood to represent a worst case scenario for surfaces that were dry before the spill occurred as the DCOF of the test surfaces were measured immediately after the SLS was applied and well before it was noticeably absorbed.

For surfaces that may be saturated at the time a spill occurs, as could be the case for slabs exposed to continuously wet conditions or hydrostatic pressure, or which are already saturated with standing water as might be the case in exterior applications while it is raining, the DCOF of those surfaces cannot be anticipated from the results of this research. We suggest CPAA and others may want to consider a cautionary statement to that effect and record the moisture content under which the DCOF measurements were made to avoid confusion if subsequent measurements are made under different moisture conditions (note: moisture measurements can be made by a variety of methods so the method of measurement should also be noted. This research did not include moisture measurements, but the slab was allowed to dry for 33 days before testing). Further they may want to consider a statement that interior polished concrete surfaces are intended to be maintained in a dry state.

Please note that TCNA makes no representation that the DCOF values reported herein are representative of any surfaces other than the unique and actual surfaces tested, including without limitation, surfaces of similar composition and polish. Further, these tests and this report do not indicate fitness for any particular purpose and TCNA makes no such representation. The suitability of any flooring for a specific project must be determined by a competent professional**.** Under no circumstances will TCNA be liable to any person or business entity for any damages, including without limitation any and all direct, indirect, special, incidental, consequential, or exemplary damages, resulting, in whole or in part, from any interpretation or conclusion drawn from these results that is not specifically contained herein and limited to the actual surfaces tested. The foregoing limitation of liability is a fundamental element of the use of this information and the information would not be offered by TCNA without such limitation.



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ANSI SPECIFICATIONS*:

According to the ANSI A137.1, "Unless otherwise specified, tiles suitable for level interior spaces expected to be walked upon when wet shall have a wet DCOF of 0.42 or greater when tested using SLS solution as per the procedure in section 9.6. However, tiles with a DCOF of 0.42 or greater are not necessarily suitable for all projects. The specifier shall determine tiles appropriate for specific project conditions, considering by way of example, but not in limitation, type of use, traffic, expected contaminants, expected maintenance, expected wear, and manufacturers' guidelines and recommendations."

This paragraph is excerpted from Section 6.2.2.1.10 of the standard. For the complete section, including necessary information for specifiers, this section can be viewed and downloaded at no cost at http://www.tcnatile.com/images/pdfs/6.2.2.1.10_A137.1COF_Website.pdf

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APPENDIX A: Diagrams, Raw Data, and Charts

Diagram 1:

The diagram below shows the concrete slab broken up into the various test sections. The three digit code in the test sections show the pad # - aggregate exposure - gloss level. Gray sections were unfinished areas around the slab.

Aggregate Exposures: A-Cream, B-Sand Salt & Pepper, C-Medium Aggregate, D-Large Aggregate

Gloss Level: 1-Low Gloss, 2-Medium Gloss, 3-High Gloss, 4-Very High Gloss

Large Agg	Med Agg	Salt & Pepper	Cream		Large Agg	Med Agg	Salt & Pepper	Cream		Large Agg	Med Agg	Salt & Pepper	Cream					
1-D-1	1-C-1	1-B-1	1-A-1	LG	2-D-1	2-C-1	2-B-1	2-A-1	LG	3-D-1	3-C-1	3-B-1	3-A-1					
1-D-2	1-C-2	1-B-2	1-A-2	MG	2-D-2	2-C-2	2-B-2	2-A-2	MG	3-D-2	3-C-2	3-B-2	3-A-2					
1-D-3	1-C-3	1-B-3	1-A-3	HG	2-D-3	2-C-3	2-B-3	2-A-3	HG	3-D-3	3-C-3	3-B-3	3-A-3					
1-D-4	1-C-4	1-B-4	1-A-4	VHG	2-D-4	2-C-4	2-B-4	2-A-4	VHG	3-D-4	3-C-4	3-B-4	3-A-4					
No Testing Per CPAA	No Testing Per CPAA	No Testing Per CPAA	No Testing Per CPAA		No Testing Per CPAA	No Testing Per CPAA	No Testing Per CPAA	No Testing Per CPAA		No Testing Per CPAA	No Testing Per CPAA	No Testing Per CPAA	No Testing Per CPAA					

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Diagram 2: The diagram below shows the randomly selected test samples for each test section. This was done using the random number generation function in Microsoft excel to ensure that it was truly random. In section 3-B-4 (marked with an asterisk), sample areas 1, 2, and 3 were chosen because of circular polishing marks left on the bottom half of the test section. There were no other test sections containing such marks, therefore the area with polishing marks was considered an anomaly and not used for testing.

3' / 4'

1	2	3
4	5	6
7	8	9
10	11	12

	Pad #1			Pad # 2				Pad #3			
Section	Sample 1	Sample 2	Sample 3	**Section**	Sample 1	Sample 2	Sample 3	**Section**	Sample 1	Sample 2	Sample 3
1-D-1	7	9	10	**2-D-1**	1	2	3	**3-D-1**	2	8	10
1-D-2	3	7	10	**2-D-2**	3	5	7	**3-D-2**	3	5	6
1-D-3	7	10	11	**2-D-3**	2	11	12	**3-D-3**	7	8	9
1-D-4	2	7	9	**2-D-4**	4	5	12	**3-D-4**	7	9	12
1-C-1	5	10	12	**2-C-1**	5	7	11	**3-C-1**	3	4	9
1-C-2	3	9	10	**2-C-2**	2	4	11	**3-C-2**	4	9	12
1-C-3	3	6	9	**2-C-3**	2	5	11	**3-C-3**	5	7	11
1-C-4	2	6	12	**2-C-4**	4	7	11	**3-C-4**	5	11	12
1-B-1	5	6	11	**2-B-1**	6	7	11	**3-B-1**	3	8	10
1-B-2	2	4	12	**2-B-2**	3	7	10	**3-B-2**	1	4	7
1-B-3	8	2	3	**2-B-3**	6	9	12	**3-B-3**	1	5	7
1-B-4	4	7	11	**2-B-4**	3	7	9	**3-B-4**	1*	2*	3*
1-A-1	6	8	10	**2-A-1**	2	9	12	**3-A-1**	7	11	12
1-A-2	1	11	12	**2-A-2**	1	7	10	**3-A-2**	4	8	9
1-A-3	6	7	9	**2-A-3**	2	11	12	**3-A-3**	6	8	10
1-A-3	2	7	11	**2-A-4**	5	10	12	**3-A-4**	2	5	11

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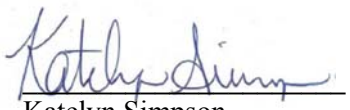
Raw Data:

Low Gloss															
	Large Aggregate				Medium Aggregate				Sand Salt & Pepper				Cream		
	Pad 1	Pad 2	Pad 3		Pad 1	Pad 2	Pad 3		Pad 1	Pad 2	Pad 3		Pad 1	Pad 2	Pad 3
1-1	0.57	0.55	0.54	1-1	0.57	0.58	0.56	1-1	0.57	0.60	0.56	1-1	0.56	0.58	0.58
1-2	0.57	0.55	0.54	1-2	0.59	0.59	0.55	1-2	0.57	0.62	0.58	1-2	0.56	0.57	0.58
1-3	0.56	0.56	0.54	1-3	0.59	0.62	0.56	1-3	0.57	0.61	0.58	1-3	0.56	0.58	0.60
1-4	0.58	0.56	0.55	1-4	0.59	0.59	0.55	1-4	0.57	0.59	0.58	1-4	0.55	0.57	0.59
2-1	0.59	0.56	0.54	2-1	0.56	0.62	0.56	2-1	0.57	0.57	0.56	2-1	0.55	0.58	0.59
2-2	0.58	0.56	0.54	2-2	0.57	0.61	0.56	2-2	0.57	0.56	0.57	2-2	0.56	0.58	0.58
2-3	0.57	0.55	0.56	2-3	0.57	0.59	0.56	2-3	0.57	0.58	0.57	2-3	0.56	0.58	0.58
2-4	0.58	0.56	0.55	2-4	0.57	0.60	0.56	2-4	0.57	0.58	0.56	2-4	0.56	0.57	0.59
3-1	0.58	0.56	0.54	3-1	0.62	0.60	0.55	3-1	0.57	0.59	0.57	3-1	0.57	0.58	0.55
3-2	0.57	0.55	0.54	3-2	0.61	0.59	0.56	3-2	0.57	0.61	0.57	3-2	0.57	0.58	0.56
3-3	0.60	0.55	0.54	3-3	0.60	0.59	0.56	3-3	0.60	0.58	0.58	3-3	0.57	0.57	0.57
3-4	0.60	0.57	0.55	3-4	0.61	0.58	0.55	3-4	0.55	0.61	0.57	3-4	0.57	0.58	0.58
Average	0.58	0.56	0.54	Average	0.59	0.60	0.56	Average	0.57	0.59	0.57	Average	0.56	0.58	0.58
Max	0.60	0.57	0.56	Max	0.62	0.62	0.56	Max	0.60	0.62	0.58	Max	0.57	0.58	0.60
Min	0.56	0.55	0.54	Min	0.56	0.58	0.55	Min	0.55	0.56	0.56	Min	0.55	0.57	0.55
St. Dev	0.012	0.007	0.007	St. Dev	0.020	0.014	0.005	St. Dev	0.011	0.019	0.008	St. Dev	0.007	0.005	0.014



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Laboratory Manager

Raw Data Continued:

Medium Gloss															
	Large Aggregate				Medium Aggregate				Sand Salt & Pepper				Cream		
	Pad 1	Pad 2	Pad 3		Pad 1	Pad 2	Pad 3		Pad 1	Pad 2	Pad 3		Pad 1	Pad 2	Pad 3
1-1	0.52	0.51	0.51	1-1	0.53	0.48	0.52	1-1	0.54	0.56	0.52	1-1	0.55	0.55	0.53
1-2	0.54	0.55	0.53	1-2	0.54	0.49	0.53	1-2	0.54	0.57	0.54	1-2	0.55	0.57	0.55
1-3	0.52	0.51	0.53	1-3	0.54	0.49	0.53	1-3	0.56	0.56	0.53	1-3	0.57	0.56	0.55
1-4	0.53	0.55	0.53	1-4	0.55	0.50	0.52	1-4	0.56	0.58	0.55	1-4	0.55	0.57	0.56
2-1	0.51	0.53	0.52	2-1	0.52	0.50	0.49	2-1	0.54	0.56	0.55	2-1	0.56	0.55	0.53
2-2	0.53	0.53	0.52	2-2	0.51	0.51	0.49	2-2	0.56	0.57	0.56	2-2	0.57	0.55	0.53
2-3	0.52	0.54	0.53	2-3	0.52	0.50	0.50	2-3	0.56	0.57	0.56	2-3	0.56	0.55	0.53
2-4	0.53	0.56	0.53	2-4	0.53	0.50	0.49	2-4	0.55	0.58	0.54	2-4	0.57	0.55	0.53
3-1	0.52	0.51	0.54	3-1	0.52	0.55	0.51	3-1	0.56	0.56	0.54	3-1	0.53	0.56	0.53
3-2	0.54	0.54	0.55	3-2	0.52	0.54	0.51	3-2	0.55	0.58	0.55	3-2	0.54	0.55	0.55
3-3	0.53	0.55	0.52	3-3	0.53	0.54	0.51	3-3	0.56	0.57	0.54	3-3	0.54	0.54	0.56
3-4	0.54	0.54	0.54	3-4	0.53	0.54	0.55	3-4	0.55	0.58	0.54	3-4	0.54	0.53	0.56
Average	0.53	0.54	0.53	Average	0.53	0.51	0.51	Average	0.55	0.57	0.54	Average	0.55	0.55	0.54
Max	0.54	0.56	0.55	Max	0.55	0.55	0.55	Max	0.56	0.58	0.56	Max	0.57	0.57	0.56
Min	0.51	0.51	0.51	Min	0.51	0.48	0.49	Min	0.54	0.56	0.52	Min	0.53	0.53	0.53
St. Dev	0.010	0.017	0.011	St. Dev	0.011	0.024	0.019	St. Dev	0.009	0.009	0.012	St. Dev	0.014	0.011	0.014

Katelyn Simpson
Laboratory Manager

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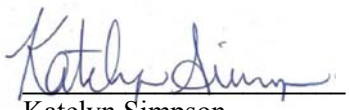
Raw Data Continued:

High Gloss															
	Large Aggregate				Medium Aggregate				Sand Salt & Pepper				Cream		
	Pad 1	Pad 2	Pad 3		Pad 1	Pad 2	Pad 3		Pad 1	Pad 2	Pad 3		Pad 1	Pad 2	Pad 3
1-1	0.51	0.52	0.52	1-1	0.53	0.53	0.52	1-1	0.50	0.54	0.55	1-1	0.54	0.51	0.55
1-2	0.52	0.52	0.50	1-2	0.53	0.50	0.52	1-2	0.51	0.52	0.54	1-2	0.49	0.50	0.56
1-3	0.52	0.52	0.52	1-3	0.51	0.48	0.51	1-3	0.51	0.55	0.54	1-3	0.50	0.51	0.56
1-4	0.53	0.51	0.49	1-4	0.51	0.45	0.53	1-4	0.50	0.54	0.54	1-4	0.51	0.51	0.55
2-1	0.51	0.51	0.52	2-1	0.53	0.51	0.51	2-1	0.51	0.54	0.54	2-1	0.52	0.47	0.53
2-2	0.52	0.49	0.52	2-2	0.51	0.48	0.52	2-2	0.50	0.54	0.53	2-2	0.53	0.49	0.55
2-3	0.51	0.50	0.51	2-3	0.52	0.49	0.51	2-3	0.52	0.53	0.52	2-3	0.53	0.48	0.53
2-4	0.52	0.51	0.50	2-4	0.50	0.48	0.51	2-4	0.50	0.49	0.54	2-4	0.53	0.49	0.55
3-1	0.48	0.49	0.52	3-1	0.53	0.52	0.51	3-1	0.49	0.55	0.52	3-1	0.52	0.51	0.53
3-2	0.47	0.49	0.51	3-2	0.53	0.49	0.51	3-2	0.50	0.54	0.51	3-2	0.51	0.49	0.54
3-3	0.50	0.47	0.55	3-3	0.53	0.50	0.50	3-3	0.52	0.54	0.52	3-3	0.52	0.50	0.53
3-4	0.49	0.49	0.54	3-4	0.50	0.49	0.51	3-4	0.51	0.53	0.53	3-4	0.51	0.52	0.54
Average	0.51	0.50	0.52	Average	0.52	0.49	0.51	Average	0.51	0.53	0.53	Average	0.52	0.50	0.54
Max	0.53	0.52	0.55	Max	0.53	0.53	0.53	Max	0.52	0.55	0.55	Max	0.54	0.52	0.56
Min	0.47	0.47	0.49	Min	0.50	0.45	0.50	Min	0.49	0.49	0.51	Min	0.49	0.47	0.53
St. Dev	0.018	0.016	0.017	St. Dev	0.012	0.021	0.008	St. Dev	0.009	0.016	0.012	St. Dev	0.014	0.015	0.012



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Katelyn Simpson
Laboratory Manager

Raw Data Continued:

Very High Gloss															
	Large Aggregate				Medium Aggregate				Sand Salt & Pepper				Cream		
	Pad 1	Pad 2	Pad 3		Pad 1	Pad 2	Pad 3		Pad 1	Pad 2	Pad 3		Pad 1	Pad 2	Pad 3
1-1	0.47	0.49	0.52	1-1	0.51	0.50	0.52	1-1	0.50	0.53	0.44	1-1	0.48	0.49	0.53
1-2	0.44	0.51	0.53	1-2	0.53	0.50	0.54	1-2	0.49	0.52	0.43	1-2	0.47	0.52	0.56
1-3	0.47	0.47	0.53	1-3	0.50	0.49	0.52	1-3	0.47	0.52	0.46	1-3	0.49	0.50	0.52
1-4	0.46	0.47	0.52	1-4	0.50	0.48	0.52	1-4	0.43	0.54	0.41	1-4	0.45	0.53	0.54
2-1	0.49	0.47	0.51	2-1	0.49	0.48	0.52	2-1	0.50	0.53	0.46	2-1	0.51	0.52	0.51
2-2	0.48	0.47	0.53	2-2	0.49	0.45	0.53	2-2	0.47	0.52	0.48	2-2	0.51	0.51	0.54
2-3	0.48	0.50	0.53	2-3	0.42	0.48	0.52	2-3	0.51	0.53	0.49	2-3	0.52	0.51	0.48
2-4	0.48	0.49	0.52	2-4	0.44	0.45	0.53	2-4	0.47	0.51	0.45	2-4	0.53	0.51	0.47
3-1	0.50	0.49	0.52	3-1	0.52	0.51	0.49	3-1	0.51	0.54	0.48	3-1	0.51	0.50	0.53
3-2	0.47	0.51	0.52	3-2	0.51	0.51	0.48	3-2	0.50	0.54	0.48	3-2	0.52	0.47	0.54
3-3	0.45	0.51	0.51	3-3	0.48	0.51	0.52	3-3	0.50	0.52	0.49	3-3	0.48	0.49	0.54
3-4	0.45	0.49	0.51	3-4	0.46	0.50	0.52	3-4	0.46	0.53	0.46	3-4	0.50	0.49	0.56
Average	0.47	0.49	0.52	Average	0.49	0.49	0.52	Average	0.48	0.53	0.46	Average	0.50	0.50	0.53
Max	0.50	0.51	0.53	Max	0.53	0.51	0.54	Max	0.51	0.54	0.49	Max	0.53	0.53	0.56
Min	0.44	0.47	0.51	Min	0.42	0.45	0.48	Min	0.43	0.51	0.41	Min	0.45	0.47	0.47
St. Dev	0.018	0.016	0.008	St. Dev	0.033	0.021	0.017	St. Dev	0.024	0.010	0.025	St. Dev	0.024	0.017	0.028

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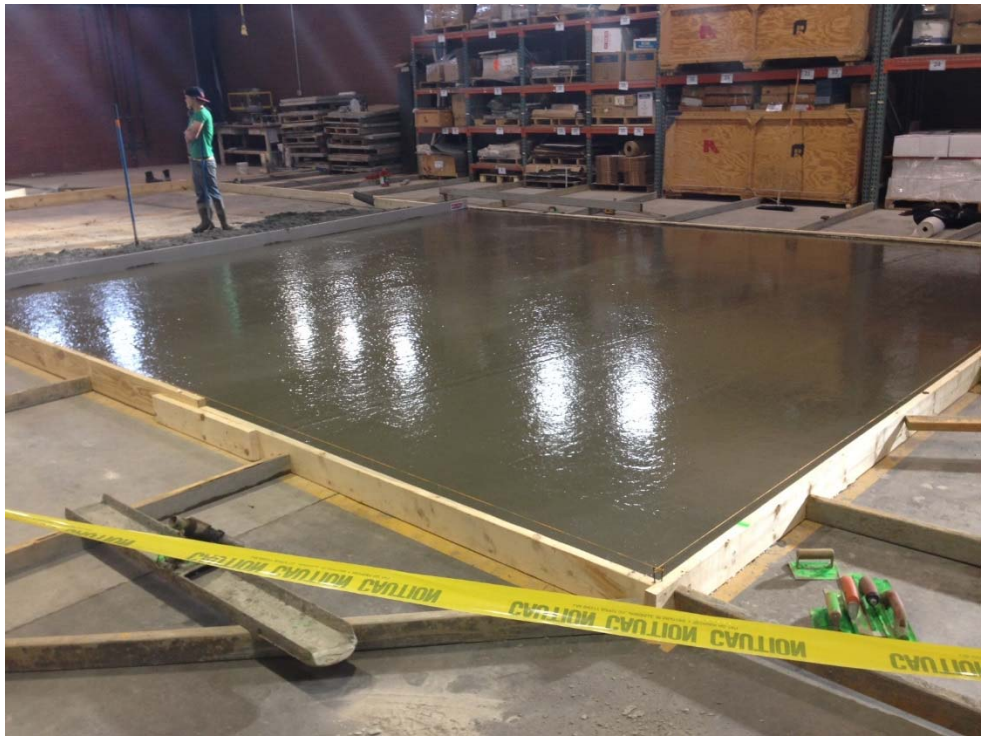
APPENDIX B: Photos



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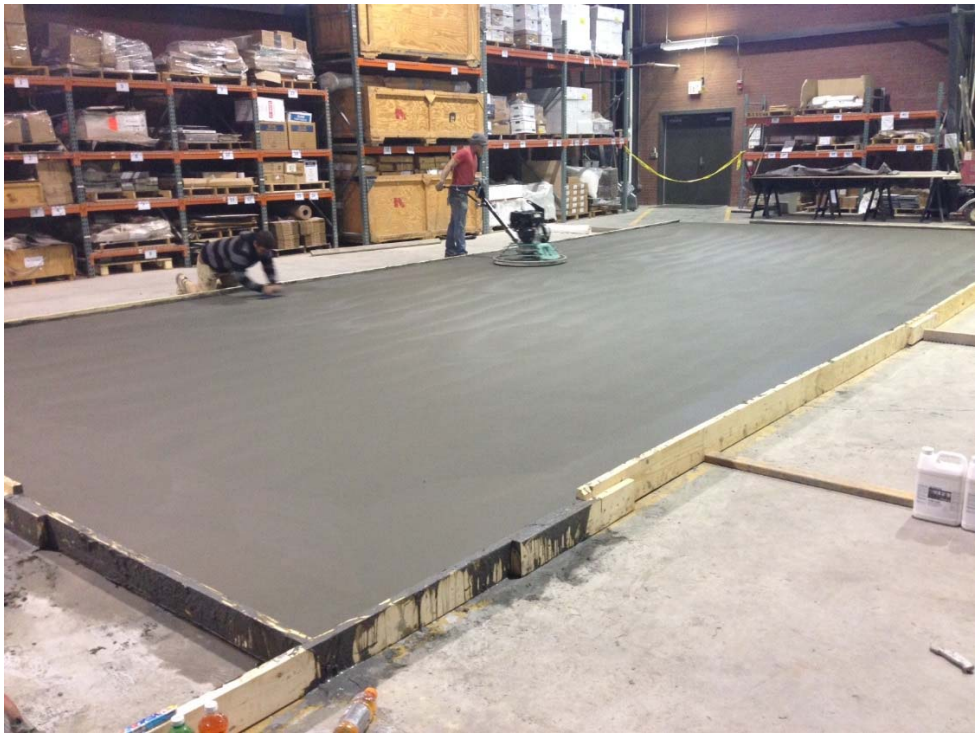

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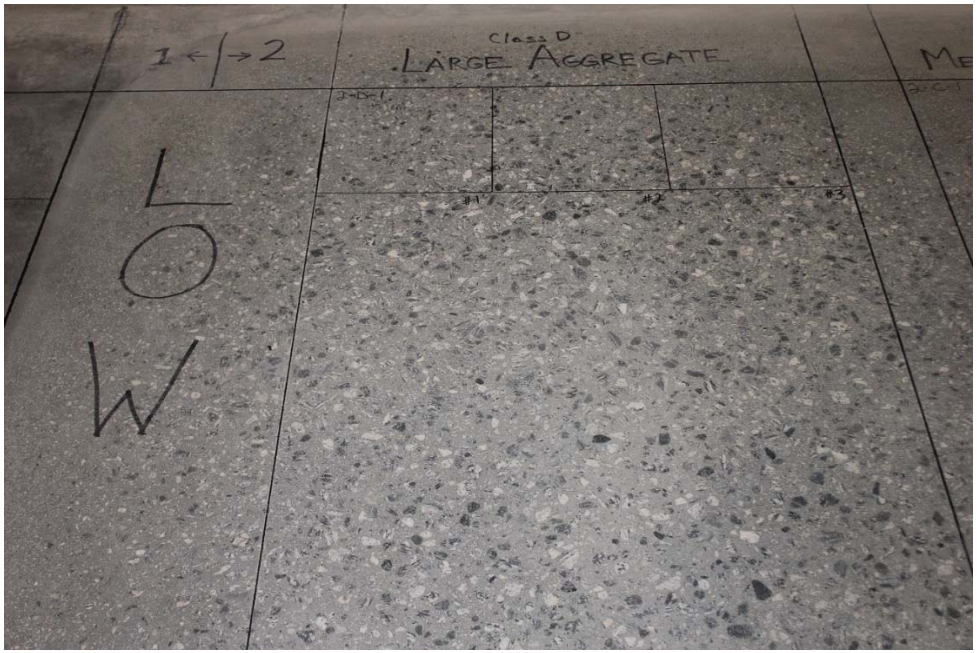

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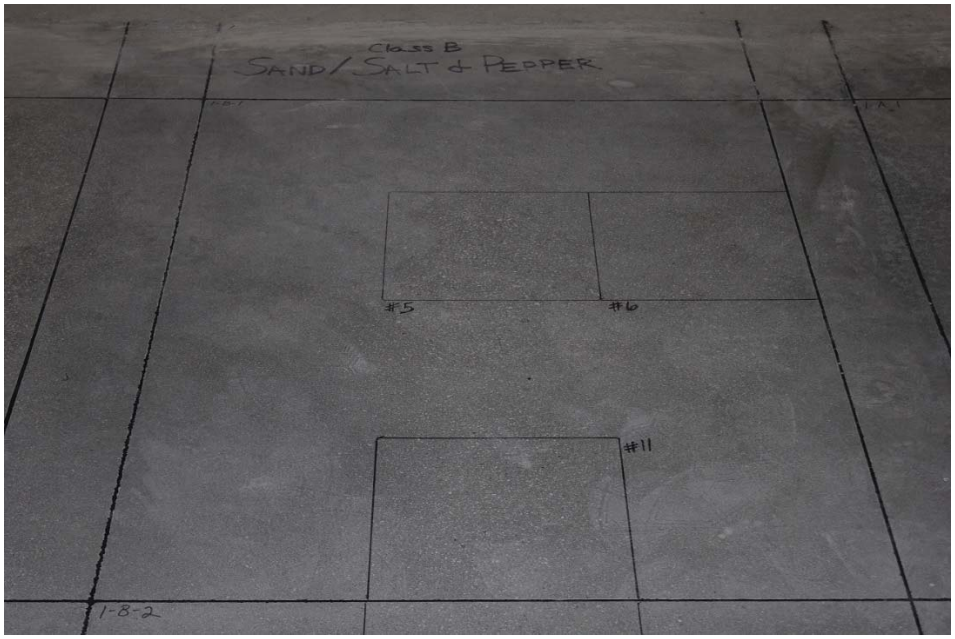

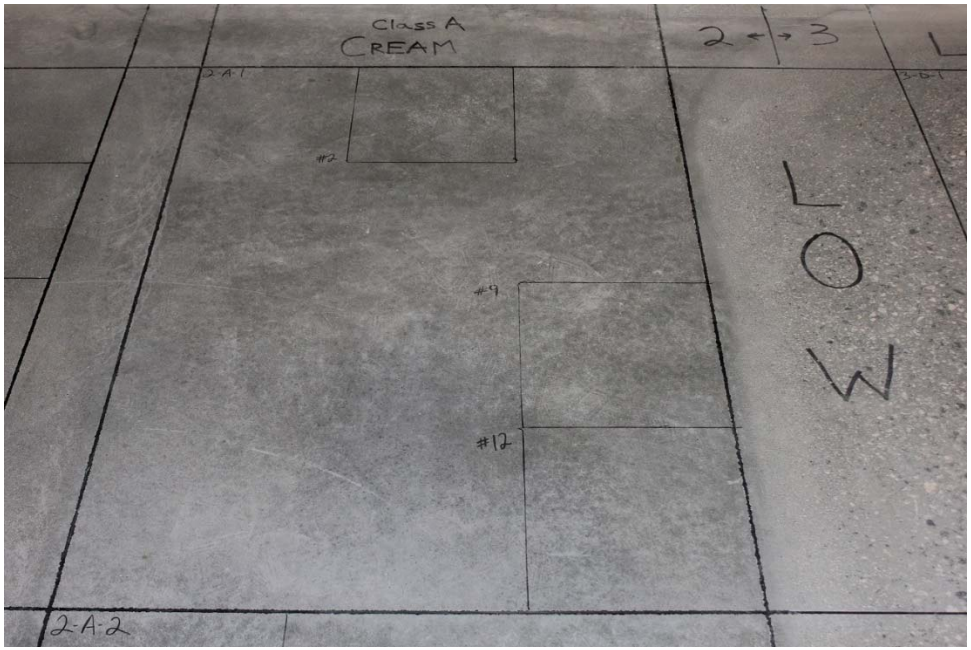

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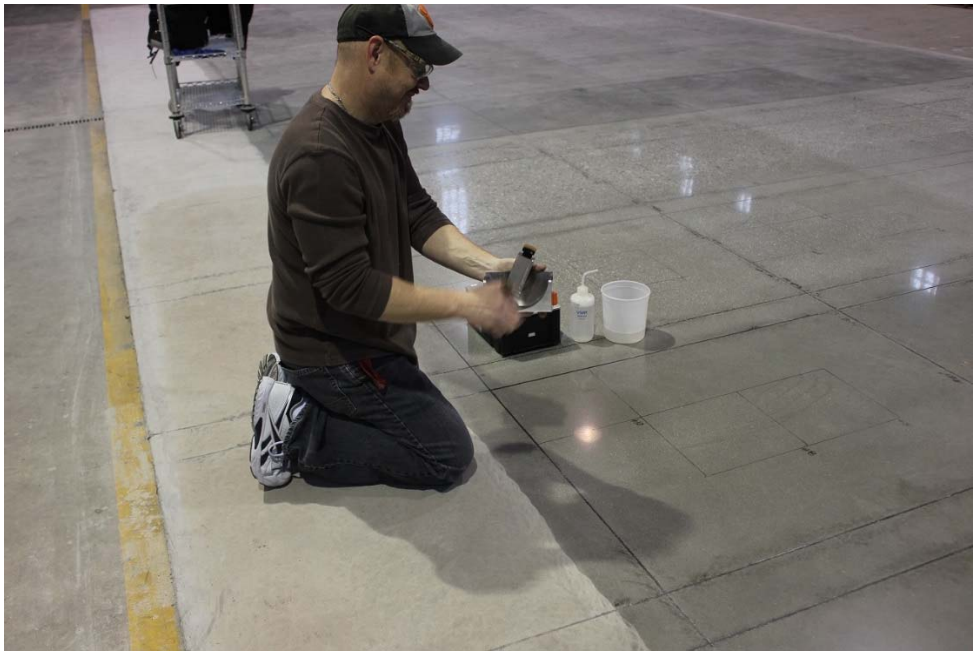

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